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EXAMINER

KNABLE, GEOFFREY L

ART UNIT PAPER NUMBER

1733

DATE MAILED: 12/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/649,827

Applicant(s)

SCHROCK ET AL.

Examiner

Geoffrey L. Knable

Art Unit

1733

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 06 October 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 36-42, 44-47, 49-60 and 62-65 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 37 and 51-57 is/are allowed.
- 6) ☒ Claim(s) 36, 38-42, 44-47, 49, 50, 58-60 and 62-65 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \*   c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_                      6) ☐ Other: \_\_\_\_\_

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 36, 38-42, 44-47, 49, 50, 58-60 and 62-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fogal et al. (US 5,140,404) taken in view of Sawamura et al. (US 6,303,219) and optionally the admitted state of the prior art.

These references are applied for the same reasons as set forth in the last office action.

3. Claims 37 and 51-57 are allowed as noted in the last office action.

4. Applicant's arguments filed October 6, 2003 have been considered and are convincing with respect to the previous rejection under 35 USC 112 but are otherwise not persuasive.

Applicant first argues that the prior art does not teach "all" of the requirements of the claim, specific reference being made to the requirements in the various independent claims for attaching the die to an adhesive on a carrier, the adhesive comprising a hybrid material. This argument has been carefully considered but is incorrect and unpersuasive. Attaching semiconductor dies to substrates using double-sided adhesive carried on a polyimide film (and thus contacting the adhesive on one side of the film to the die) is known and conventional in this art - Fogal et al. was cited as exemplary (e.g. note col. 5, lines 3-48; col. 2, lines 1-5; and col. 3, lines 10-21). As such, attaching a die to a carrier with attached "second" adhesive represents a known technique in bonding semiconductor dies to substrates and to the extent that applicant is urging otherwise, such is plainly contradicted by the cited evidence. At issue then is the use of a hybrid

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adhesive for such bonding, it being acknowledged that although Fogal et al. would have indicated that thermosetting and thermoplastic resins are each known and suitable, it does not suggest a hybrid adhesive as claimed. Sawamura et al. however is also directed to adhesively attaching semiconductors to substrates and in particular teaches using an adhesive having a thermosetting component and a thermoplastic component (e.g. col. 7, lines 50+; col. 13, lines 29+; col. 17, lines 12+), **this being taught to provide numerous advantages in adhesive strength, reliability, processing, etc.** (e.g. cols. 3-4 as well as the last 8 lines of the abstract). To utilize such an adhesive for the adhesive for the conventional double-sided tape to adhere a semiconductor would therefore have been obvious in light of the expected advantages suggested by Sawamura et al. Applicant's argument that not "all" of the claimed requirements are taught is therefore unconvincing - while they are not all taught in a *single* reference, it is considered that taken together, the ordinary artisan would have been strongly motivated to adopt an adhesive including a thermosetting component and a thermoplastic component as the adhesive for the conventional double sided tape as conventionally used to adhere a semiconductor in light of the expected advantages suggested by Sawamura et al.

Applicant then urges that

"the assertion "to utilize such an adhesive for the adhesive for the conventional double sided tape to adhere a semiconductor would therefore have been obvious in light of the expected advantages suggested by Sawamura et al." made on page 3 of the office action is a mere conclusory statement that fails to provide any objective evidence that legally establishes a case of obviousness" (page 9 of the response).

This argument is unconvincing. This statement is of course a legal conclusion of obviousness but contrary to applicant's contention, it is supported by the objective evidence that was discussed in the lines that preceded it - namely that evidenced by principally Fogal et al. and Sawamura et al. This is thus not an unsupported "mere conclusory statement" but rather is a legal conclusion of obviousness based on the evidence provided by the cited prior art.

It is then urged (apparently referring to the same conclusion of obviousness) that

"the assertion as to motivation amounts to a form of Official Notice, which is timely traversed under MPEP 2144.03. Applicant respectfully requests that the Examiner either cite references in support of this position, or provide an affidavit..." (page 10 of the response).

This argument is unconvincing. A legal conclusion of obviousness supported by facts evidenced by cited prior art is not a form of "Official Notice." No additional references or affidavit is required and none will be provided. The legal conclusion of obviousness is supported by the applied prior art, the particular advantages suggested by Sawamura et al. to accompany use of an adhesive containing both thermoplastic and thermosetting components to bond semiconductors providing the motivation to use such as the adhesive for conventional double sided adhesive tapes used to bond semiconductors to substrates.

Applicant then quotes another passage from the last office action and emphasizes the statement that "it would have been apparent that an adhesive suitable for one-sided bonding would have been expected to be suitable for a double sided methodology." Applicant then concludes that this is "based on a subjective belief and unknown authority, since no art nor objective teaching was cited" (page 10 of the

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response). Applicant has however again taken a conclusion that follows an explicit discussion of the teachings of the references and then ignored the factual discussion of the references. Further, and most importantly, this discussion was provided merely to contradict any contention that use of an adhesive as taught by Sawamura et al. would not have been reasonably expected to suitably bond in the context of a two sided tape bonding methodology, it being again noted that Fogal et al. is considered to clearly support a conclusion that the artisan would have understood that bonding using one sided tapes and that using a double-sided tape (figs. 4-5) are both known and are simply obvious alternatives to effect bonding of a die to a substrate.

Applicant also urges that the tapes in figs. 3 and 5 of Sawamura already include a substrate such that they are not used to bond a substrate to a die. This argument has been carefully considered but is unconvincing of the non-obviousness of the invention. First, it should be emphasized that Sawamura et al. is not being used as principal evidence for the use of a double-sided tape to bond semiconductor dies to a substrate. Rather, Fogal et al. was cited as evidence that it is known in this art to use double-sided (as well as single-sided) adhesive tapes to bond semiconductor dies to substrates (this being in place of the typical paddle + adhesive systems). Sawamura et al. was cited as evidence that adhesives including both thermoplastic and thermosetting components can suitably and effectively bond a semiconductor die to a substrate as well as provide advantages as compared to thermosetting or thermoplastic adhesives alone. Note again that the adhesive of Sawamura et al. is being used to among other things bond a semiconductor to a substrate (e.g. col. 11, lines 7+) and it is indicated that

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"A thermoplastic resin functions to enhance adhesiveness and flexibility, to ease thermal stress and to enhance insulatability due to low water absorbability, and a thermosetting resin is necessary to realize the balance of physical properties such as heat resistance, insulatability at high temperature, resistance to chemical and the strength of the adhesive layer" (col. 7, lines 50-60).

Applicant has provided no convincing line of argument that would establish that the artisan would not have found or expected such an adhesive to suitably and effectively function in the very analogous and known use of an adhesive tape for bonding the die to the substrate. In other words, a principal teaching of Sawamura is a new adhesive formulation that has distinct and significant processing and end product advantages as compared to conventional adhesives - i.e. Sawamura notes that the adhesive provides:

- "(a) High adhesive strength not allowing peeling even at a reflow temperature of 230.degree. C. or higher.
- (b) Moderate elastic modulus and moderate coefficient of linear expansion to ease the thermal stress acting on the different materials forming the connecting substrate due to temperature cycles and reflow.
- (c) Processability to allow sticking together and low temperature short time thermal cure.
- (d) Insulatability in lamination on wiring" (col. 3, lines 9-17)

Sawamura further indicates that achieving the above noted properties at the same time is difficult:

"it has been especially difficult to achieve a balance between adhesive strength on the one hand and moderate elastic modulus and coefficient of linear expansion on the other hand. In the conventional adhesive compositions, if the adhesive strength is attempted to be improved, the elastic modulus at high temperature drops to pose a problem that totally satisfactory properties cannot be obtained.

In general, the adhesive strength of an adhesive can be enhanced by lowering the elastic modulus to increase the breaking energy, but this method presents a

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problem in that at high temperature and high humidity, the adhesive is softened, to lower the reflow resistance as well as the adhesive strength at high temperature and high humidity. On the other hand, if the crosslinking degree of the adhesive is increased to improve the reflow resistance and the adhesive strength at high temperature and high humidity, the adhesive is likely to cause brittle fracture, and the internal stress due to curing shrinkage increases, to unpreferably lower the adhesive strength on the contrary. Furthermore, the effect for easing the thermal stress caused by temperature difference is also lost.

An object of the present invention is to solve these problems, and to provide a new adhesive sheet for a semiconductor connecting substrate excellent in processability, adhesive strength, insulation reliability and durability, and also to provide a semiconductor connecting substrate and a semiconductor device using it" (col. 3, lines 18-45).

Thermal stress, adhesive strength, high temperature properties, etc. are of course important in almost any adhesive bonding process but further are clearly known to be of concern in this art in particular - this is clearly evidenced by Sawamura et al. but is also evidenced by Fogal et al. (e.g. col. 2, lines 22-30) and the apparent admitted state of the prior art (page 5, lines 4-7). The ability of an adhesive to provide this advantageous balance of properties in the bonding of semiconductors to substrates would therefore have strongly motivated the artisan to utilize such an adhesive in any conventional process used in bonding semiconductor die to substrates, this including the known use of two-sided tape with adhesive coated thereon.

With respect to the examiner's position with reference to claims 64 and 65, applicant urges that:

"the assertions amount to a form of Official Notice, which is timely traversed under MPEP 2144.03. Applicant respectfully requests that the Examiner either cite references in support of this position, or provide an affidavit..." (page 11 of the response).



This argument is unconvincing. While the examiner is referring to applicant's specification, this is merely referenced in order to understand the scope and content of the relevant claims, and to help determine whether it is a reasonable conclusion that the reference disclosure, although using different terminology/parameters to describe the adhesive components, is in fact describing components that meet/render obvious a compositions as claimed. It is further noted that applicant indicates that the selection of the high and low Tg components is done to satisfy or balance competing requirements of high thermal stability and low lamination temperature - as noted above, however Sawamura et al. is also directed to essentially this *same end result* - namely providing an adhesive with both high thermal stability and low thermal cure temperatures. Thus, although the claims characterize the components in a different manner than the reference, insofar as both applicant and Sawamura desire high thermal stability and low thermal cure temperatures and both applicant and Sawamura et al. achieve these results by blending thermoset components and thermoplastic components in the adhesive, it is submitted to not have been unreasonable to expect that the artisan's component selections following the teachings of Sawamura would provide components that would also meet the claimed Tg requirements, the burden properly shifting to applicant to show otherwise - see *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980).


5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Geoffrey L. Knable whose telephone number is 571-272-1220. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on 703-308-3853. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0651.

  
Geoffrey L. Knable  
Primary Examiner  
Art Unit 1733

G. Knable  
December 13, 2003